REMARKS

Claims 1-29 are pending in this Office Action. Claims 1-29 were rejected in the Office action. In this response, claims 1, 18, 24, and 27 are amended and claim 30 and 31 are new. Claim 1-31 are pending.

Claim Rejection under § 102

The Office action states:

> 7. Claims 1, 2, 4-6, 16-19, 21, 24, 25 and 27 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 5,463,164 issued to Perkins, et al.

Applicants disagree. Perkins is directed to a different problem than the claim invention and, as a result, Perkins does not disclose the claimed invention. Perkins is directed to the disposal of solid material in poorly consolidated formation. (Perkins, Abstract : "Unconsolidated or lightly cemented formation zones may be used for waste disposal wherein it is determined that a substantial compaction of the material defining opposed faces of hydraulic fractures may occur.") Poorly or unconsolidated material usually have little or no stress anisotropy (equal horizontal stresses). Perkins discusses the creation of channels that propagate in different directions. (Perkins, Figs. 2-3) Perkins's method depends on compaction of rock with little or no elastic behavior to generate wider channels. (Perkins, Abstract, claim 1) The assumed compaction (plasticity) of the rock will prevent the interference between the fractures and allow the creation of many channels (fractures). For example, Perkins states:

> In accordance with another important aspect of the present invention, a method is provided for predicting the volume of a slurry which may be injected into a disposal zone in an earth formation wherein undercompacted and/or lightly cemented formation material exists which becomes substantially compacted rather than elastically deflected. The present invention contemplates that irreversible compaction results from failure of mineral grains and grain-cementing materials thus allowing the porosity of the formation to decrease. When the compaction process occurs in the vicinity of a hydraulic fracture, the fracture width will be larger than it otherwise would be for the same slurry pressure.

(Perkins, 2:23-35)

Perkins proceeds to calculate volume of fractures assuming the total lack of stress interference. Perkins first claim demonstrates that Perkins's method requires compaction of rock which happens in poorly or even unconsolidated formations:

> 1. A method for disposing of particulate waste solids in the form of a slurry into the earth from an injection well, comprising the steps of:
>
> locating an earth formation disposal zone bounded at least one of above or below by an earth formation zone having a higher in situ stress field;
>
> <u>forming a hydraulic fracture in said earth formation disposal zone</u>;
>
> <u>determining the compaction of the formation in the disposal zone caused by said hydraulic fracture formed in the disposal zone at selected pressures</u>;
>
> determining the fracture volume based on the i n situ stress distribution, the fracture length and height and said compaction; and
>
> injecting a predetermined volume of solids laden slurry through said well into the disposal zone.

(Perkins, claim 1 emphasis added)

By contrast, in the claimed invention elasticity is considered. As a fracture is created, stress surrounding the fracture changes. The effect of multiple fractures is cumulative. The effect at any point depends, for example, on the dimensions and net pressure of each fracture as well as the distance from each of those fractures. This consideration of elasticity is shown, for example, when claim 1 requires, in part, "determining one or more geomechanical stresses induced by each fracture based on the dimensions and location of each fracture." The Office action maps this element to Perkins as follows:

> As per Claim 1, Perkins et al discloses a method of optimizing a number, placement and size of fractures in a subterranean formation (See: Equation 1, 2, and 9 the generation of # of fractures, height, radius and width) comprising the steps of:
>
> (a) determining one or more geomechanical stresses induced by each fracture based on the dimensions and location of each

> fracture (such as "S1 and S2 of equation 1"; See: Co. 4 lines 1-22, equation 1);

(Office action, 3)

Applicants respectfully disagree. Perkins states that "S_1 is the average opposing earth stress in the injection zone; and S_2 is the opposing earth stress in the top and/or bottom boundary zones." (Perkins, 4:1-4). Perkins's S1 and S2 are earth stresses and not stresses induced by each fracture as required by the claim. This is because Perkins's equation 1 determines the ratio H/H_f, where H_f is the fracture height and H is the high of the injection or disposal zone 23. Neither equation 1, nor any other discussion in Perkins discloses determining geomechanical stresses induced by each fracture, as required by this claim element.

Furthermore, Perkins's equation 1 is not *based on the location of each fracture*, as required by the claim. Neither Perkins's equation 1, nor any other portion of Perkins discloses determining geomechanical stresses induced by each fracture *based on the location of each fracture*, as required by this claim element.

Claim 1 further requires, "determining a predicted stress field based on the geomechanical stresses induced by each fracture." The Office action maps this element to Perkins as follows:

> determining a predicted stress field based on the geomechanical stresses induced by each fracture (such as "S1 and S2 of equation 1"; See: Co. 4 lines 1-22, equation 1)

(Office action, 3)

As discussed above, Perkins does not disclose determining stresses induced by each fracture. Similarly, Perkins does not disclose the determination of a predicted stress field as required by this claim element. Perkins's S1 and S2 are earth stresses and not stresses induced by each fracture as required by the claim. This is because Perkins's equation 1 determines the ratio H/H_f, where H_f is the fracture height and H is the high of the injection or disposal zone 23. Neither equation 1, nor any other discussion in Perkins disclose determining a predicted stress field based on the geomechanical stresses induced by each fracture, as required by this claim element.

Claim 1 further requires, "generating an optimized number, placement and size for two or more fractures in a subterranean formation, where generating the optimized number, placement and size for one or more fractures in a subterranean formation is based, at least in part, on one or more of: the geomechanical maximum number of fractures; and the predicted stress field based on the geomechanical stresses induced by each fracture." Applicants have amended this limitation to clarify that the generation of an optimized number, placement and size is for two or more fractures. This limitation, when read in light of the, first and third limitations ("determining one or more geomechanical **stresses induced by each fracture** based on the dimensions and location of each fracture" and "determining a **predicted stress field based on the geomechanical stresses induced by each fracture**") demonstrates that the effect of an earlier fracture is considered when determining whether a subsequent fracture will be made and, if so, its size and location.

The Office action maps this element to Perkins as follows:

> (d) generating an optimized number, placement and size for one or more fractures in subterranean, where generating the optimized number, placement and size for one or more fractures in a subterranean formation is based, at least in part (See: Equation 1, 2, and 9 the generation of # of fractures, height , radius and width), one or more of: the geomechanical maximum number of fractures; and the predicted stress field based on the geomechanical stresses induced by each fracture (See: Equations 1, 2, and 9).

(Office action, 3)

As discussed above, Perkins does not disclose determining stresses induced by each fracture. Similarly, Perkins does not disclose the determination of a predicted stress field as required by this claim element. Perkins's S1 and S2 are in-earth stresses and not stresses induced by each fracture as required by the claim. This is because Perkins's equation 1 determines the ratio H/H_f, where H_f is the fracture height and H is the high of the injection or disposal zone 23. Neither equation 1, nor any other discussion in Perkins disclose determining a predicted stress

field based on the geomechanical stresses induced by each fracture, as required by this claim element. Because Perkins does not determine the stress field based on the geomechanical stresses induced by each fracture it cannot (and does not) generate an optimized number placement, and size for one or more fractures based on the predicted stress fields.

Independent claims 18 and 24 include similar limitations that are also not disclosed by Perkins. All remaining claims depend from one of claims 1, 18, or 24 and are therefore patentable over the art.

Furthermore, claim 4 further requires "spacing the fractures a uniform distance from each other." The Office action states that:

> d. As per Claim 4, Perkins et al discloses the method according to claim 1, further comprising the step of spacing the fractures a uniform distance from each other (such as "fractures which extends equally in two directions"; See: Col. 6 lines 10-16).

(Office action, 4)

Applicants respectfully disagree. The cited portion of Perkins discusses the propagation of individual fractures. By contrast, the claim is directed to the spacing between fractures. Perkins does not disclose spacing fractures a uniform distance from each other, as required by the claim.

Furthermore, claim 6 further requires "creating one or more fractures in the subterranean formation and repeating steps (a), (b), and (c) after each fracture is created." The Office action states that:

> f. As per Claim 6, Perkins et al discloses the method according to claim 1, further comprising the steps of: creating one or more fractures in the subterranean formation; and repeating steps (a), (b), and (c) after each fracture is created (See: Col. 2 lines 3-13).

(Office action, 4)

Applicants disagree. As discussed above, Perkins does meet the claim limitation because it does not perform steps (a), (b), and (c) for the reasons presented above with respect to claim 1.

Claim 6 requires that the steps be performed after each fracture is created and Perkins makes no disclosure of performing this step. The cited portion of Perkins discusses:

> In accordance with an important aspect of the present invention, an earth formation zone is selected and a predetermined quantity of waste material is injected thereinto based on a determination of the volume of the fracture. Fracture volume is determined based on expected fracture height, the expected fracture length or radial extent of the fracture (or fractures) from the injection well and fracture width including a determination of elastic deflection of the surrounding earth and inelastic compaction of the earth material on both sides of the fracture, i.e. the compaction of the earth material defining both fracture faces.

(Perkins, 2:3-13)

This cited portion does not discuss making any calculations as each fracture is created, much less the steps (a), (b), and (c), as required by the claim. For at least these reasons, Applicants request that the rejections of claim 1-29 be withdrawn.

SUMMARY

Applicants contend that the claims are in condition for allowance, which action is requested. Should any additional fees be required, Applicants request that the fees be debited from deposit account number 02-0383.

Respectfully submitted,

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Date: June 11, 2010